Amendments to the Drawings:

The attached drawing sheets include changes to FIGS. 1, 2 and 4, respectively. These sheets replace the original drawing sheets including FIGS. 1, 2 and 4. In each of FIGS. 1, 2 and 4, reference signs have been added as mentioned in the detailed description.

Attachment : Replacement Sheets
Annotated Sheets Showing Changes

REMARKS

The present amendment is submitted in response to the Office Action mailed July 10, 2006. Claims 1 – 13 are currently pending in the application. No new matter or issues are believed to be introduced by this amendment. In view of the amendments above and the remarks to follow, reconsideration and allowance of this application are respectfully requested.

Allowed Claims

Applicant wishes to thank the Examiner for indicating that Claims 5, 6 and 9 contain allowable subject matter and would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants have elected to rewrite dependent Claim 5 in independent form including all of the limitations of independent Claim 1, and dependent claims 2 and 4 (see new Claim 11). Hence, it is believed that Claim 11 is in condition for allowance. Applicants have also elected to rewrite dependent Claim 6 in independent form including all of the limitations of independent Claim 1 and dependent claims 2, 4 and 5 (see new Claim 12). Hence, it is believed that Claim 12 is in condition for allowance. Applicants have also elected to rewrite dependent Claim 9 in independent form including all of the limitations of independent Claim 1 and dependent claim 8 (see new Claim 13). Hence, it is believed that Claim 13 is in condition for allowance.

Drawing Objection

In the Office Action, the drawings were objected to for failing to include reference labels as specified in the detailed description. Proposed new drawings, Figures 1, 2 and 4, are provided in response to the objection. Applicants respectfully request withdrawal of the drawings objection and approval of the enclosed proposed drawing changes.

35 U.S.C. §102(b)

Claims 1-4, 7, 8 and 10 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,884,039 –King et al. (hereinafter King).

Applicants respectfully traverse the rejection of claims 1-4, 7-8 and 10 under 35 U.S.C. §102(b), however, Claim 1 has have been amended. It is respectfully submitted that claims 1-4, 7-8 and 10 are patentable over King for at least the following reasons.

It is respectfully submitted that there are a number of fundamental distinctions between King and the present application with regard to (1) principles of operation, (2) implementation and (3) application. Each of the three areas of distinction are discussed as follows.

(1) Distinctions between King and Present Application based on Principles of Operation

As stated above, King and the present application exhibit significant differences with regard to principles of operation. These distinctions are as follows:

- One distinction between King and the present application based on principles of operation is that the differential amplifier of King is based on time-discrete signals, while the present application is based on continuous-time signals.
- A second distinction between King and the present application is that the differential amplifier of King operates in two phase, namely, an offset-nulling phase and an amplification phase (referred to as *sampling* in King). In contrast, offset compensation is performed once in accordance with the invention. It is performed either after manufacturing, e.g., such as during testing, or in operation at power on. Accordingly, the operational amplifier of the invention amplifies the input signal one-hundred percent (100%) of the time.
- A third distinction between King and the present application is that, in King, compensation currents are applied to two nodes, namely, nodes 20 and 22, which are very sensitive nodes. The two very sensitive nodes of King determine the bandwidth and the stability of the differential amplifier, both of which are key performance parameters. By adding additional connections to these nodes, as shown in Figs. 1 and 2 of King, parasitic capacitance is introduced, which lowers the resistance. As a result, bandwidth and stability are altered by the added offset compensation means. In contrast, the compensation current in the present application is fed to a single, insensitive node, having virtually no effect on the op-amp.
- A fourth distinction between King and the present application is that, in King, a second amplifier, namely, INV is required to amplify the offset signal. The amplified offset is

stored on a capacitor and is simultaneously applied to one of the offset compensation means. This forms a negative feedback. The offset compensation relies on this feedback. In contrast, feedback may or may not exist in the op-amp of the invention. When it occurs, the information may be stored in an EEPROM, and offset compensation by a second stage is not required. As shown in Fig. 2 of the present application, MPA-C, MNA and MNB form a single stage op-amp to convert Vc into a current Ic, rather than to amplify the offset signal.

- A fifth distinction between King and the present application is that, in King, two compensation currents, namely, I3 and I4, are required. In contrast, only a single compensation current, Ic, is required in the present invention. In a related distinction, the compensation currents of King, I3 and I4, are DC unidirectional currents. In contrast, the single compensation current, Ic, is a bidirectional current. In a further related distinction, the compensation currents of King, I3 and I4, are continuously flowing currents. In contrast, the single compensation current of the invention, Ic, ceases to flow (reduces to zero) when offset compensation is achieved.

(2) Distinctions between King and Present Application based on Implementation

As stated above, King and the present application exhibit significant differences with regard to implementation. These distinctions are as follows:

- One distinction between King and the present application is that in the differential amplifier of King, node 22 is a very sensitive node affecting performance and stability. As such, the differential amplifier of King may require redesign to ensure performance and stability. In contrast, using the offset compensation technique of the present invention, there is no influence, adverse or otherwise, on stability and performance.
- A second distinction between King and the present application is that, King requires a linear transconductance to generate compensation currents I3 and I4, requiring the addition of two degeneration resistors (42 and 44) to the differential pair of P3 and P4. In contrast to King, the present invention does not require a linear transconductor at all. Any circuit with output current covering the required range can be used. Transistors MPA-MPC and MNA-MNB can be replaced, for example, by a single MOS transistor with a current source.
- A third implementation based distinction between King and the present application is that the differential amplifier of King requires a reference voltage source 50, while the op-amp of the present invention does not. The bias can be as simple as shown (MP3).
- A fourth implementation based distinction between King and the present application is that the differential amplifier of King requires an external capacitor. In contrast, the op-amp of the present invention provides a solution for full integration. For example, offset information can be stored in an on-chip EEPROM.

(3) Distinctions between King and Present Application based on Application

As stated above, King and the present application exhibit significant differences with regard to application. These distinctions are as follows:

- One distinction between King and the present application is that the differential amplifier of King can only be used in applications where time discrete amplification is allowed. That is, they may not be used in continuous-time applications. A second application based distinction between King and the present application is that in King there is a need for an anti-alias filter and a smoothing filter. This is true due to the chopper operation of the differential amplifier of King. The anti-alias filter is required to avoid aliasing. After amplification, a smoothing filter is required to remove the clock signal and its harmonics.

Independent Claim 1 has been amended herein to reflect certain of the afore-mentioned distinctions between King and the present application based on the afore-mentioned areas of distinction, namely, principle of operation, implementation and application.

Claim 1 as amended herein recites:

1. Operational amplifier **for processing continuous time signals**, comprising means for introducing **one** additional current to **one** internal **nonsensitive** node of said operational amplifier for reducing an output offset voltage of said operational amplifier.

It is respectfully submitted that at least the limitations and/or features of Claim 1 which are underlined above is not anticipated by the disclosure of King.

Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) with respect to Claim 1 and allowance thereof is respectfully requested.

Claims 2-4 and 7-8 depend from independent Claim 1 and therefore contain the limitations of Claim 1 and is believed to be in condition for allowance for at least the same reasons given for Claim 1 above. Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) and allowance of Claims 2-4 and 7-8 is respectfully requested.

Independent Claim 10, as amended, recites similar subject matter as Claim 1 and therefore contain the limitations of Claim 1. Hence, for at least the same reasons given for Claim 1, Claim 10 is believed to be allowable over King. Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) and allowance of Claim 10 is respectfully requested.

35 U.S.C. §102(b)

Claims 1-4, 7, 8 and 10 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,622,521 – Redfern et al. (hereinafter Redfern).

Applicants respectfully traverse the rejection of claims 1-4, 7-8 and 10 under 35 U.S.C. §102(b), however, Claim 1 has have been amended in the manner described above. It is respectfully submitted that claims 1-4, 7-8 and 10 are patentable over Redfern for at least the following reasons.

It is respectfully submitted that there are a number of fundamental distinctions between Redfern and the present application with regard to (1) principles of operation, (2) implementation and (3) application. Each of the three areas of distinction are discussed as follows.

(1) Distinctions between Redfern and Present Application based on Principles of Operation

As stated above, Redfern and the present application exhibit significant differences with regard to principles of operation. These distinctions are as follows:

- One distinction between Redfern and the present application based on principles of operation is that the differential amplifier of Redfern is based on time-discrete signals, while the present application is based on continuous-time signals.
- A second distinction between Redfern and the present application is that the differential amplifier of Redfern operates in two phase, namely, an offset-nulling phase and an amplification phase. In contrast, offset compensation is performed once in accordance with the invention. It is performed either after manufacturing, e.g., such as during testing, or in operation at power on. Accordingly, the operational amplifier of the invention amplifies the input signal one-hundred percent (100%) of the time.
- A third distinction between Redfern and the present application is that, in Redfern, compensation currents are applied to two nodes, namely, V1 and V2, which are very sensitive nodes. The two very sensitive nodes of Redfern determine the bandwidth and the stability of the differential amplifier, both of which are key performance parameters.

By adding additional connections to these nodes, as shown in Figs. 1 and 2 of Redfern, parasitic capacitance is introduced, which lowers the resistance. As a result, bandwidth and stability are altered by the added offset compensation means. In contrast, the compensation current in the present application is fed to a single, insensitive node, having virtually no effect on the op-amp.

- A fourth distinction between Redfern and the present application is that, in Redfern, a second amplifier, namely, N3 and IB3 is required to amplify the offset signal. The amplified offset is stored on a capacitor and is simultaneously applied to one of the offset compensation means. This forms a negative feedback. The offset compensation relies on this feedback. In contrast, feedback may or may not exist in the op-amp of the invention. When it occurs, the information may be stored in an EEPROM, and offset compensation by a second stage is not required. As shown in Fig. 2 of the present application, MPA-C, MNA and MNB form a single stage op-amp to convert Vc into a current Ic, rather than to amplify the offset signal.
- A fifth distinction between Redfern and the present application is that, in Redfern, two compensation currents, namely, drain to source currents of N1A and N2A, are required. In contrast, only a single compensation current, Ic, is required in the present invention. In a related distinction, the compensation currents of Redfern, are DC unidirectional currents. In contrast, the single compensation current, Ic, is a bidirectional current. In a further related distinction, the compensation currents of Redfern, are continuously flowing

currents. In contrast, the single compensation current of the invention, Ic, ceases to flow (reduces to zero) when offset compensation is achieved.

(2) Distinctions between Redfern and Present Application based on Implementation

As stated above, Redfern and the present application exhibit significant differences with regard to implementation. These distinctions are as follows:

- One distinction between Redfern and the present application is that in the differential amplifier of Redfern, V1 is a very sensitive node affecting performance and stability. As such, the differential amplifier of Redfern may require redesign to ensure performance and stability. In contrast, using the offset compensation technique of the present invention, there is no influence, adverse or otherwise, on stability and performance.
- A second distinction between Redfern and the present application is that in Redfern, MN2 is added to node V1 and N1A is added to node 2 and the amplified offset information is applied to the gate of N1a. By contrast, node B of the op-amp of the present invention is not modified at all and Ic is only applied to insensitive node C, which is reduced to zero after the offset is compensated.
- A third implementation based distinction between Redfern and the present application is that the differential amplifier of Redfern requires an external capacitor. In contrast, the op-amp of the present invention provides a solution for full integration. For example, offset information can be stored in an on-chip EEPROM.

(3) ***Distinctions between Redfern and Present Application based on Application***

As stated above, Redfern and the present application exhibit significant differences with regard to application. These distinctions are as follows:

- One distinction between Redfern and the present application is that the differential amplifier of Redfern can only be used in applications where time discrete amplification is allowed. That is, they may not be used in continuous-time applications.
- A distinction between Redfern and the present application is that in Redfern there is a need for an anti-alias filter and a smoothing filter. This is true due to the chopper operation of the differential amplifier of Redfern. The anti-alias filter is required to avoid aliasing. After amplification, a smoothing filter is required to remove the clock signal and its harmonics.

Independent Claim 1 has been amended in the manner described above, based in part on the the afore-mentioned distinctions between Redfern and the present application based on principle of operation, implementation and application.

Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) with respect to Claim 1 and allowance thereof is respectfully requested.

Claims 2-4 and 7-8 depend from independent Claim 1 and therefore contain the limitations of Claim 1 and is believed to be in condition for allowance for at least the same reasons given for

Claim 1 above. Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) and allowance of Claims 2-4 and 7-8 is respectfully requested.

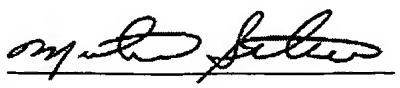
Independent Claim 10, as amended, recites similar subject matter as Claim 1 and therefore contain the limitations of Claim 1. Hence, for at least the same reasons given for Claim 1, Claim 10 is believed to be allowable over King. Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) and allowance of Claim 10 is respectfully requested.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims presently pending in the application, namely, Claims 1-13 are believed to be in condition for allowance and patentably distinguishable over the art of record.

If the Examiner should have any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to call Mr. Paul Im, Intellectual Property Counsel, Philips Electronics North America, at 914-945-9627.

Respectfully submitted,



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Appl. No. 10/524,570
Reply to Office Action of July 10, 2006
Annotated Sheet Showing Changes

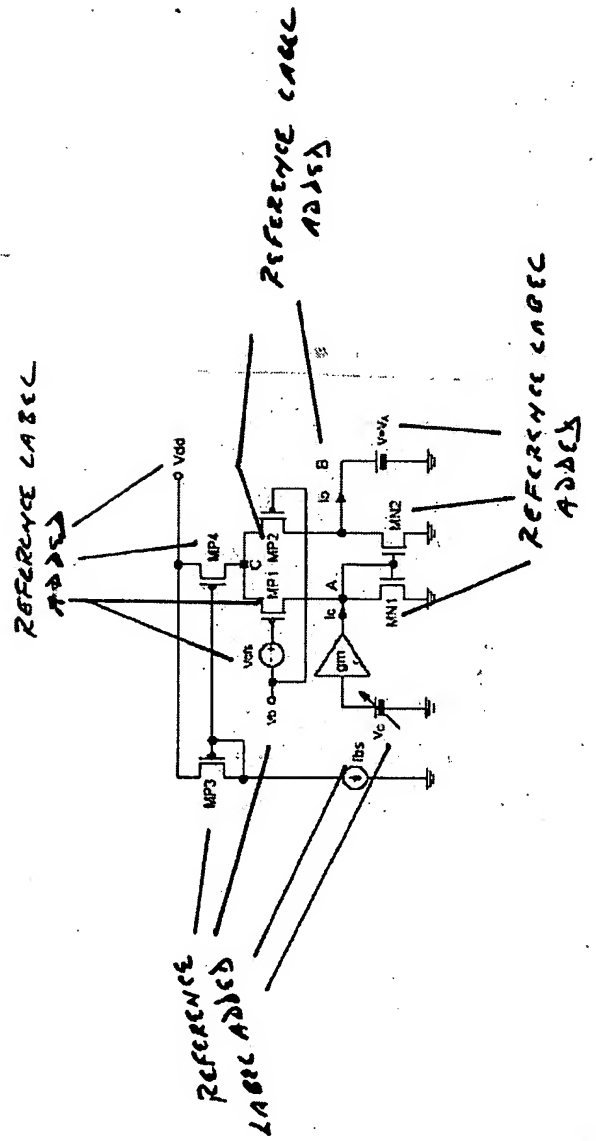

FIG. 1

Appl. No. 10/524,570
Reply to Office Action of July 10, 2006
Annotated Sheet Showing Changes

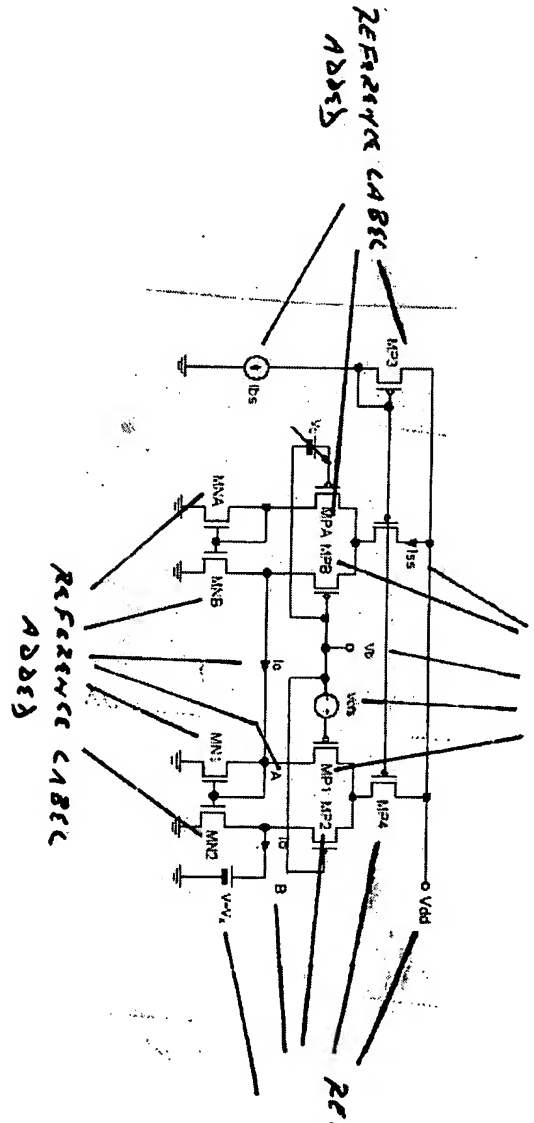

FIG. 2

Appl. No. 10/524,570
Reply to Office Action of July 10, 2006
Annotated Sheet Showing Changes

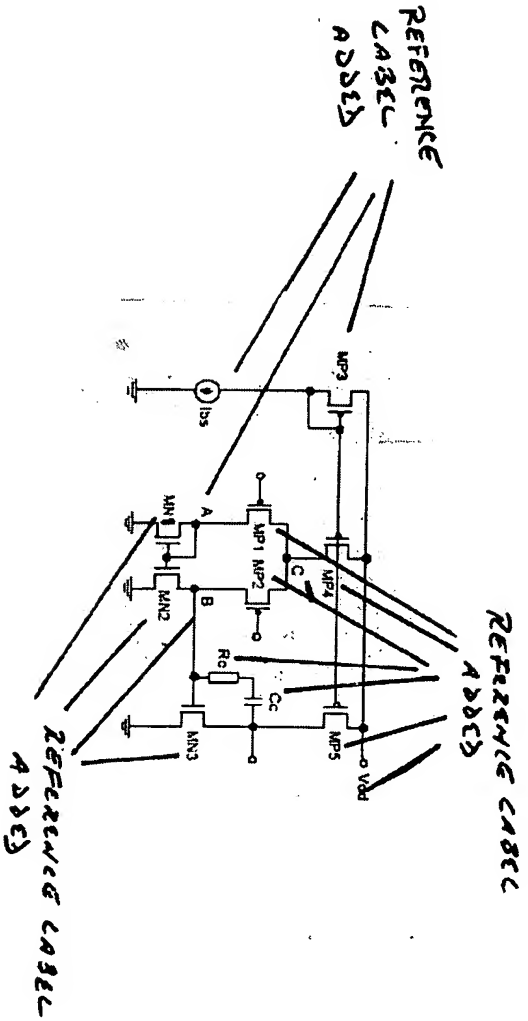

FIG. 4